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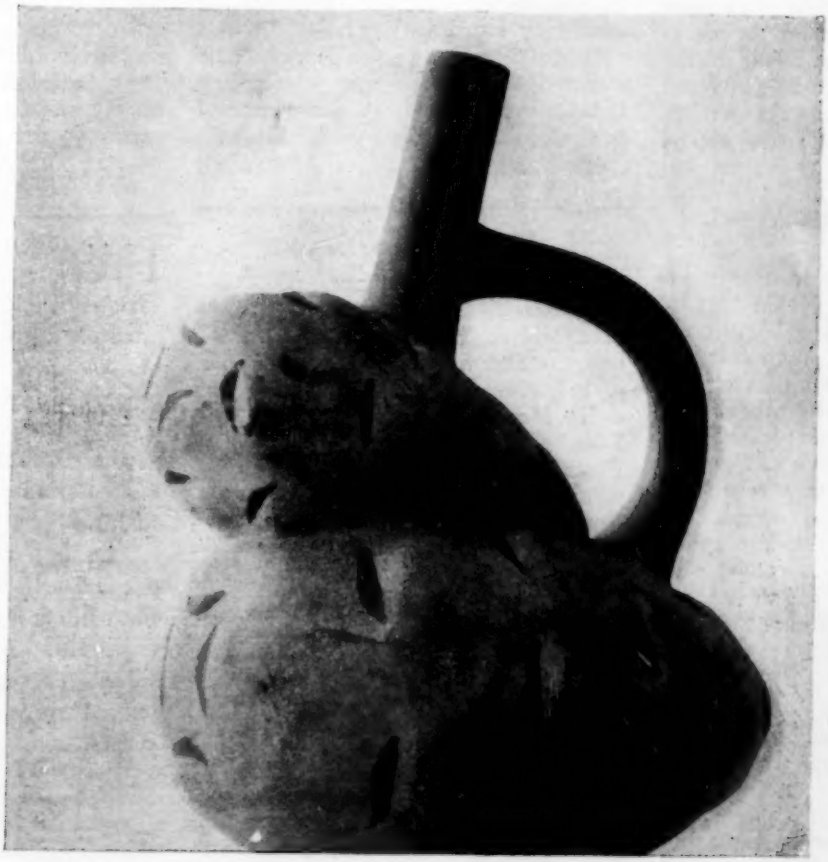
SCIENCE NEWS-LETTER

The Weekly Summary of Current Science

A SCIENCE SERVICE PUBLICATION

$5 a year 15c a copy September 1, 1928



EARLY AMERICAN WARE

Ancient Peruvians Made Pots Like Potatoes

(*See page* 124)

Vol. XIV *No. 386*

Indian Girl Saves Legends of Race

Anthropology

By FRANK G. SPECK

Dr. Speck is professor of anthropology at the University of Pennsylvania.

From the Indians of Massachusetts, if anyone can be induced to believe that there are any, a marvelous epic is being woven into form. It is an epic of the days before the arrival of the Pilgrims on Cape Cod and the neighboring islands, in the early part of the seventeenth century. It is an epic of a hero and creator couched in the phrases of fable and legend, depicting the creation and transformation of the region now embraced between Boston Bay and Vineyard Sound. With the battering down of the last outpost of the Indian settlements during King Philip's War the dwindling remnants sought refuge on the desolate moors on the extreme end of the Island of Kapawok, "the land covered with clouds", as it was known to them, the Martha's Vineyard of today.

In the picturesque but barren uplands of Gay Head they retreated to secure peace and liberty from the encroachments of the land-seizing whites and here they still reside to the number of several hundred. Little known to the outside world, happy in their fishing and seafaring life, they have evaded the prying interests of investigators who have hitherto remained ignorant of the meaning of the legends preserved in the closets of memory of the older generation. Sedulously refusing to communicate legendary secrets to the questions of the white aliens their reserve has been at last penetrated by one of their own race, a young Indian girl, Gladys Tantaquidgeon, who has just returned from Gay Head with a host of treasures of legend and folk-lore to be woven into a scenic epic which, like a tapestry, will depict the primeval age when the giant God, Mashap, created and formed the land; directed the activities of his children, the Indians, and ruled the storms and waves of the southern coast of Massachusetts, where since his day so many craft have gone down beneath his wrath.

Miss Tantaquidgeon is a Mohegan Indian. The old Indians at Gay Head are a branch of the Wampanoags, the tribe that under King Philip so strenuously opposed the Pilgrims. They welcomed the Indian maiden and loosened their tongues in her behalf. This has enabled her to bring forth a connected story of their ancient and imposing legends to be admired and studied by the hosts of readers who are ever seeking for fragments of folk-lore to reconstruct the classical narratives of aboriginal races. Miss Tantaquidgeon is a student at the University of Pennsylvania in the Department of Anthropology.

Science News-Letter, September 1, 1928

Early American Ware

Archæology

Substantial suport for the commonly accepted doctrine that "Irish" potato originated in South America is found in the very ancient piece of Indian pottery now on exhibition in the Field Museum of Natural History, Chicago, which is pictured on the cover of this week's SCIENCE NEWS-LETTER. It clearly represents two potatoes of good shape and size, one lying on top of the other, with the eyes rudely but realistically shown. How old the jug is no one knows, but Dr. William M. McGovern, of the museum staff, states that it antedates the Inca conquest of the Peruvian coast.

There seems to have been a fashion among these ancient Indians for modeling their pottery in the shape of food plants, for other pieces represent peanuts, corn, squashes, pumpkins, beans and the poisonous tuber from which tapioca is made. These examples of really Early American ware are of great assistance not only to archæologists and anthropologists in the study of the ways of the people who made them, but to economic botanists interested in the discovery of the original homelands of our present-day food crops, whose history, almost without exception, runs far back and blends into the times when there was no history.

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SCIENCE NEWS-LETTER, The Weekly Summary of Current Science. Published by Science Service, Inc., the Institution for the Popularization of Science organized under the auspices of the National Academy of Sciences, the National Research Council and the American Association for the Advancement of Science. *Medical Progress* is merged into the SCIENCE NEWS-LETTER.

Edited by Watson Davis.

Publication Office, 1918 Harford Ave., Baltimore, Md. Editorial and Executive Office, 21st and B Sts., N. W., Washington, D. C. Address all communications to Washington, D. C. Cable address: Scienserve, Washington.

Entered as second class matter October 1, 1926, at the postoffice at Baltimore, Md., under the act of March 3, 1879. Established in mimeographed form March 13, 1922. Title registered as trade-mark, U. S. Patent Office.

Subscription rate—$5.00 a year postpaid. 15 cents a copy. Ten or more copies to same address, 5 cents a copy. Special reduced subscription rates are available to members of the American Association for the Advancement of Science.

Advertising rates furnished on application.

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INTERPRETING week by week, the latest developments in the various fields of science, this magazine attempts also to present its articles in the most pleasing and readable topography and the most convenient arrangement.

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All of the resources of Science Service, with its staff of scientific writers and correspondents in centers of research throughout the world, are utilized in the editing of this magazine.

Did Roger Bacon Have a Telescope?

History of Science

By James Stokley

Roger Bacon, the famous Franciscan monk who lived in England in the thirteenth century may have had a telescope, nearly four centuries before the generally accepted date of its invention in 1610. With it, possibly, he made a discovery of the nature of the spiral nebulae in the sky that anticipated one made less than a century ago, with one of the world's largest telescopes.

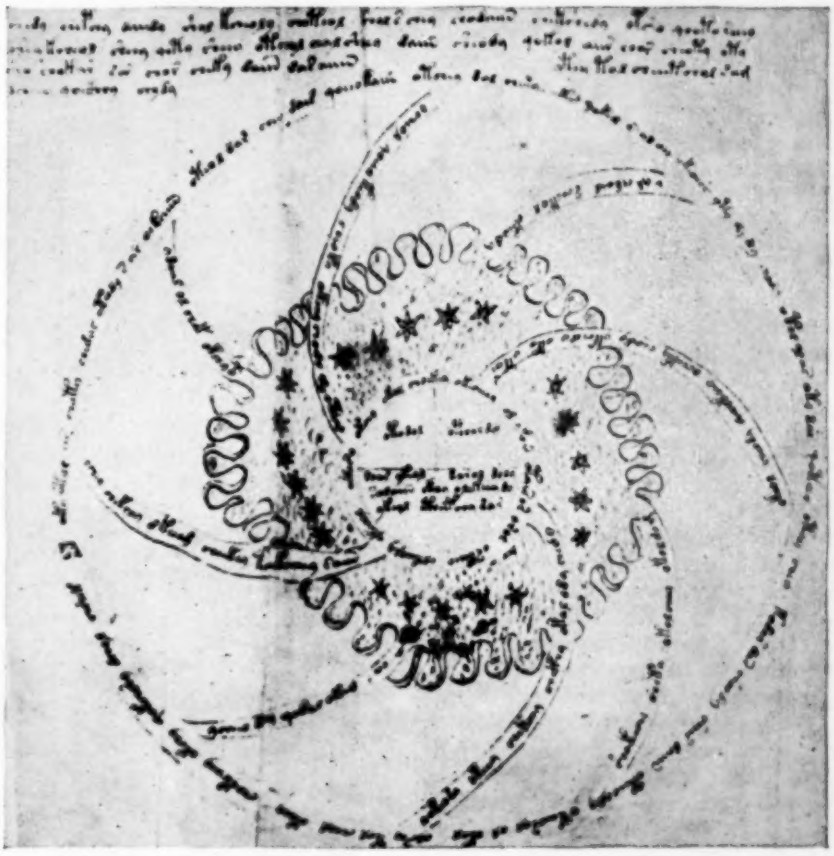
Perhaps, also, he had a microscope, and was able to observe the mechanism of reproduction, anticipating another discovery of later centuries.

Such are some of the startling conclusions that have been drawn from the study of a curious old manuscript written in cipher, that was found in an old Austrian castle in 1912. For many years before his death the late Prof. W. R. Newbold, of the University of Pennsylvania, labored over its decipherment, and the results of his studies have just been published by the university press. The title is "The Cipher of Roger Bacon", and it was edited by Dr. Newbold's colleague and friend, Prof. Roland G. Kent.

As thrilling as any mystery story is the tale of this manuscript, as pieced together by its owner and finder, Wilfrid M. Voynich of New York. After a few years of comparative freedom, Roger Bacon fell afoul of his superiors and was imprisoned in 1277. The place of his imprisonment is unknown, as is also the date of his release, but it was probably about 1290. But little good it did him, for in 1292 he died, and, according to the best authority, was buried at Oxford on June 11, 1292.

As might be expected of a man who had spent his lifetime gathering knowledge, in an age when any extraordinary learning was considered proof of communion with evil powers, Bacon evidently wanted to preserve his work. But he had to do it in a way to avoid attracting further suspicion. Another factor, pointed out by Dr. Newbold, is that, in common with the scholars of the day, Bacon considered that the man who had succeeded in penetrating one of nature's secrets had, so to speak, been taken into the confidence of God. Therefore it would be sacrilege to reveal the fruits of his labor to the vulgar.

Whatever the reason, Bacon prepared this monumental work, written entirely in cipher, yet so closely was it done that to a superficial reader it would appear to be written in ordinary, though technical, Latin. Of course, at that time, as for centuries later, Latin was the universal language of scholars in all countries.



THE CURIOUS SPIRAL STRUCTURE in the Bacon cipher, which Prof. Newbold believed to represent the Great Nebula in Andromeda, one of the closest of the spiral nebulae. The inscription at its center tells of viewing it "in a concave mirror."

Perhaps the cipher was based largely on a cipher manuscript which Bacon is known to have sent to Pope Clement IV, with whom he was friendly, in 1267, a year before the pope's death. This was sent in the hands of a youth named John, one of Bacon's trusted pupils. As he mentions in it a comet that appeared in 1273 and an eclipse of 1290, it is evident that it is not the identical manuscript that was sent to Clement. The original manuscript was long lost. Bacon's Opus Majus, or "Great Work," was sent to Clement about the same time. Within recent years the actual copy sent to the pope, with Bacon's autograph notes, has turned up in the Vatican library in Rome. As a complete cataloging of the Vatican library, the first that it has ever had, is now under way, at the expense of the Rockefeller Foundation, it is not unlikely other lost works of Bacon may come to light in the future.

In any event, after his death Bacon presumably bequeathed the Voynich manuscript to one of his students, perhaps the same John, and then, after his death, it remained in some English monastery library. During the sixteenth century, when Henry VIII dissolved the monasteries, the manuscript, along with other spoils, passed to the Duke of Northumberland. A Dr. John Dee, the prototype of Prospero in Shakespeare's "Tempest," was one of the first of the later men of learning to recognize Bacon's achievements. At the age of 26 he began to collect Bacon's works and manuscripts, finally obtaining the cipher manuscript, along with other items, from the Duke (*Turn to next page*)

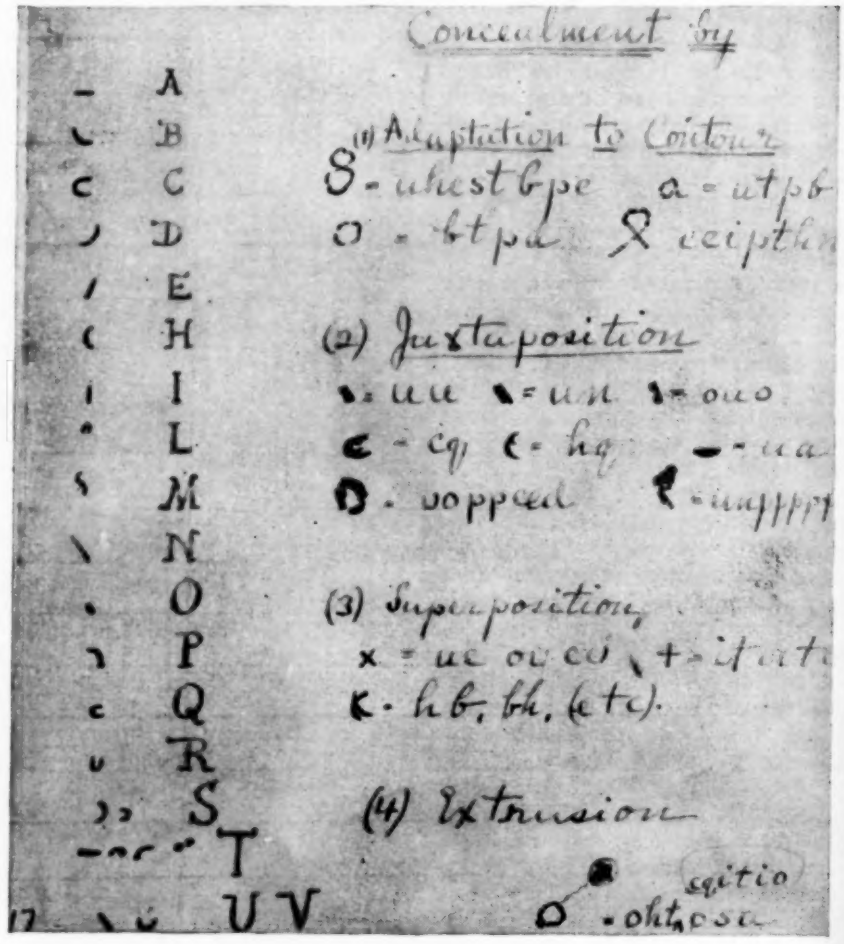
Did Roger Bacon Have a Telescope?—*Continued*

of Northumberland. Dee made several visits to the Emperor Rudolph II, at Prague, between 1584 and 1588. At that time Rudolph was one of the most enlightened of monarchs, and chief patron of sciences. Apparently Dee presented the cipher to Rudolph, with whom he had discussed Bacon at length. Some time after 1608, probably about 1611, when Rudolph abdicated, it was acquired by a Jacobus de Tepenecz, who was also interested in occult science. The next owner, who cannot be identified, probably obtained it at de Tepenecz's death in 1622, and he bequeathed it, sometime around 1640, and after unsuccessful attempts to decipher it, to a famous scientist of his time, one Marcus Marci.

In 1665 Marcus Marci presented it to Athanasius Kircher, a Jesuit scholar who is still accorded a prominent place in scientific history. The letter of Marci to Kircher transmitting the work was still in it when found in 1912. He told Kircher in the letter that the manuscript was attributed to Roger Bacon. What happened to it after Kircher's death in 1680 is unknown—apparently it went to one of his friends, who took no particular interest in it, and from whom it went to the collection in which Mr. Voynich discovered it.

In this way there came to Dr. Newbold this most elaborate and deceptive of all ciphers. So difficult is it that several scholars failed to make any sense out of it at all. Dr. Newbold was sent a couple of photographic copies of certain pages, one of which happened to be the last. On this was a curious sentence in rather mutilated Latin: "Michiton oladabas multos te tccr cerc portas." Hidden in these words is "Michi dabas multas portas" or "To me thou gavest many gates." The words left out, that "ton ola" and "te tccr cerc," Dr. Newbold found, were cipher for "R. B." and "four," so that the whole thing meant, "To me, R. B. (i. e. Roger Bacon) thou gavest many gates."

This, to Dr. Newbold, was significant. "I found a clue in the word 'portas'—'gates'," he wrote. "I had studied the Kabbalah, that curious gnostic philosophy of medieval Judaism, and I knew that Bacon had some acquaintance with the ideas best known to us as elements of the Kabbalah. Now, in the Kabbalah, the 'gates' are all the possible combinations of the letters of the Hebrew alphabet, taken two by two."



THE GREEK SHORTHAND SYSTEM which Bacon used in his cipher and the way he combined its letters so that they appeared to be other letters. This is one of Prof. Newbold's sheets of notes

"Bacon's primary aim," continues Dr. Newbold in his book, "was to construct a cipher which would give no indication of being a cipher at all, and which in consequence would arouse no curiosity and prompt no one to attempt its decipherment."

This is the way he did it.

Take an alphabet, a, b, c, d, e, f, g, etc., then combine it in turns with each of the other letters, so as to give a series of two-letter alphabets. These will be like this: aa, ab, ac, ad, ae, etc.; ba, bb, bc, bd, etc:; ca, cb, cc, etc.; and so on. Now these various alphabets, if continued to the end, will contain all the possible two letter combinations that occur in actual words.

Bacon's idea, which Dr. Newbold thought to be original and peculiar to him, was to assign to these two-letter symbols the values of single letters of the alphabet, and at the same time use the two-letter groups to build up other words. Dr. Newbold gives the following example. If one wanted to cipher the latin word "tonus," with "fi" meaning "t"; "de" for "o"; "li" for "n"; "or" for "u" and "um" for "s", then the word "fideliorum" would be the cipher word for "tonus." The cipher was extremely complicated because the cipher equivalents of the actual letters must be constantly changed. Under such handicaps, Bacon wrote his secrets for posterity.

Even this did not satisfy Bacon, so he thought of still another way to make the puzzle harder for those who followed him. This was probably original with him, for he took a Greek shorthand system that was current in the Middle Ages. As in modern shorthand, short lines, straight and curved, were used, but each character represented a letter, instead of a syllable, like systems of the present day. Dr. Newbold found that certain characters in the manuscripts, when (*Turn to page* 133)

Leprosy and Fungus

Medicine

A medical progress note prepared by the American Association for Medical Progress.

Investigations of leprosy by Dr. E. L. Walker of the University of California Medical School illustrate the difficulty of obtaining proof of the causative agent of a disease, without animal experimentation. In Honolulu Dr. Walker is working on the theory that leprosy is caused by a soil-growing organism related to the fungus, *Actinomyces*. The disease is most prevalent in countries where the natives run barefoot, and it seems probable that it is contracted by contact with the soil. Frequently it breaks out first around the feet or legs, but even when the infection has entered by way of the feet it may spread through glands and break out in other places.

Actinomyces presents a number of problems to the investigator. In the first place the conditions under which it grows in living tissue cannot be reproduced in the laboratory. And in the second place these plants assume different shapes and forms. In human tissues they appear rod-shaped, whereas in laboratory cultures they may be spherical, rod-shaped with swollen ends or threadlike and branched.

At first Dr. Walker thought that there must be several different organisms associated with leprosy, but after months of experimentation he discovered that they were all of the same breed. His theory that the disease is caused by this particular organism however, must still be regarded as tentative. Animals other than man are immune and cannot help in the investigation. Positive evidence must depend upon the changes in the sickness rates following universal adoption of shoes and a careful disinfection of all wounds, and upon the investigation of soil conditions, and the mode of infection in all parts of the world where leprosy is most common.

Science News-Letter, September 1, 1928

Study Grease Devices

Engineering

Grease measuring devices such as used by filling stations in servicing automobiles may soon be standardized. Tentative specifications and tolerances for grease measuring devices were adopted at the twenty-first National Conference on Weights and Measures. During the next year a close study will be made of the usefulness of the code.

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Measures Speed of Lightning

Physics

The speed of a lightning flash has been measured for the first time in history. It takes about one seven-thousandth of a second for it to complete itself. No part of it lasts more than approximately one thirty-five-hundredth of a second.

The old dispute, as to whether lightning strikes downward from the clouds or jumps upward from the ground has also been settled. It does both. It starts from the cloud and the ground at nearly the same instant, and approximately one seven-thousandth of a second later the two ends unite in mid-air.

These facts, representing the first actual measurements of the speed of lightning, were determined by Prof. C. V. Boys, noted British physicist, who is spending the summer at the private laboratory of Alfred L. Loomis at Tuxedo Park, N. Y. Prof. Boys obtained his measurements with a special camera which he patiently carried about the world for 26 years, attempting hundreds of photographs in vain, until a New York stroke of lightning proved to be his real stroke of good luck.

The camera has two lenses instead of the usual single lens. They are mounted on a disk and whirled rapidly while the camera is pointed at a cloud which promises good lightning flashes. When the flash comes, the camera is closed and the plate developed.

Since two moving lenses have been used, a double picture is obtained, each image slightly displaced in a direction opposite to the other. By appropriate optical measurements and geometrical calculations of this displacement the direction and rate of travel of the flash can be determined. Its duration can be learned from the width of the streaks on the plate, blurred by the motion of the lenses.

A detailed report of Prof. Boys' lightning measurement and a description of the methods employed are published in the British scientific periodical *Nature*, which appeared in London today (Saturday, Sept. 1).

Science News-Letter, September 1, 1928

New Aid for Sub Crews

Inventions

A device which experts believe will save the lives of men submerged in sunken submarines has been devised by the Naval Bureau of Construction and Repairs after years of exhaustive research.

The instrument, defined as a "breathing device," is extremely simple in operation, consisting of a bag of oxygen attached to a mouth-piece, and worn with a bathing suit or light clothes. Following a wreck, submarine crews as far down as 225 feet need merely attach the instrument and swim to the surface, navy officials explain.

Tests thus far have demonstrated the efficacy of the invention in shallow water, and tests are now under way to try it out at greater depths. A few days ago a submarine expert dived 60 feet in a diving bell, rising to the surface, he said, without any discomfort.

It is pointed out that the invention is a welcome contrast to the old-style rescue apparatus which is extremely cumbersome and weighs up to 26 pounds. The new device weighs but two pounds and takes up every little space. Plans are under consideration to equip every submarine with the breathing apparatus.

Science News-Letter, September 1, 1928

Thin Clothing Healthful

Hygiene

Women's clothing for winter has been given scientific approval as being far more healthful and more sensible than men's. Man lives in a tropical climate while woman enjoys the dry, cool atmosphere of the Alps, according to investigations made by Dr. E. Friedberger, professor of hygiene at the University of Greifswald.

The weight of man's indoor clothing is over four times that of woman's, the temperature inside man's clothing is 87.8 degrees Fahrenheit, with a relative humidity of 70 per cent., while the temperature under woman's clothing is 80.6 degrees and the humidity only 55 per cent.

Worst of all, man's closely woven and lined coat and vest keep the healthful light rays from penetrating to his skin, while the modern woman's loose, thin, unlined dress of porous material provides the continuous access of light rays to the skin, Dr. Friedberger found by experimenting with light-sensitive paper. It is this continuous exposure to small amounts of the health-giving rays that is desirable, rather than an occasional overdose on a holiday, which is all poor man gets, as a rule.

Science News-Letter, September 1, 1928

The Highways of the Birds

Ornithology

ALEXANDER WETMORE, in *The Migrations of Birds* (Harvard Press):

From previous statements it will be realized that there is infinite variety in the distances travelled by various birds in migration, and in the choice of the routes that are followed. In fact, the variety is so great that it almost seems as if the methods employed in migration by no two species exactly coincide. One species travels farther than another, one passes south and another southwest, one begins migratory movement early and another procrastinates, and so on in a highly varied assortment of differences. There are factors, however, that tend to throw floods of migration along certain lines and to leave other areas occupied to a less degree, so that there are certain general lines of migration that may be traced.

Much has been written about these paths of migration, and it is generally recognized that birds in migratory flight tend to follow lines of major topographic relief on the earth's surface when these trend in the proper direction. Lanes of migration may be relatively narrow, depending upon the habitat chosen by birds as a place to live, as exemplified by the knot, the purple sand piper, the surf-bird, and others which, except when on their breeding grounds, normally are found along sea-coasts, where their chosen home is bounded on one side by broad reaches of salt water and on the other by land or fresh water, both equally unsuited to furnish the food and haunt desired by these species and necessary to their well-being. The knot ventures somewhat casually inland, but the bulk of its flight is coastal. The others are strictly maritime in distribution except in their northern homes. These birds travel in narrow lanes from which there is no pronounced deviation.

In those species that migrate habitually overland the case is quite different, since here the migration path is broad and diffuse, with indefinite boundaries. Throughout the northern hemisphere, with the exception perhaps of such tremendous altitudes as are encountered on Mount Everest, there is in all probability no point at which migrants do not pass. In or over prairies or forested areas, mountains or valleys, deserts or marshes, lakes or plains, we find migrant birds at some time during the year, or under proper conditions hear their calls as they pass overhead at night. It is true that there are lines of pronounced concentration in migration marked by some river valley, mountain range, or other feature, but such flight lines must not be visualized as narrow paths or arterial traffic lanes, similar to the highways of humans, designed especially to carry avian travellers north and south; they are merely favored passageways in one broad fly line that is continent wide in extent. It is only at such places as Point Pelee in Lake Erie, or Whitefish Point in Lake Superior, that there is any true semblance to a narrow lane.

It must be borne in mind then, in subsequent discussion that the lines of flight suggested are merely broad lanes in which migration tends to concentrate, or general tracts through which flight is particularly abundant. Quite often we find that early arrivals among birds are noted first at points in the concentrated lanes, and that only with the rush that marks the passage of the mass of individuals of a species do they appear at stations at the side. In some forms the first bird will be seen in the course of some broad north and south river valley, and it may be several days before there is a spread to points at either side. In other species movement may come on a broad front extending indifferently across the land, so that arrivals are noted simultaneously across the line of advance. . . .

To begin in the east, the first of the major north and south lines is one that leads directly south across the Atlantic Ocean from the coasts of Nova Scotia and Labrador through or past Bermuda, perhaps extending in part through the Bahamas and the larger West Indian Islands, to the Lesser Antilles, and then down the course of these small islands to the mainland of South America. No land birds are known to make the long sea flight that this journey entails, but it is a regular route in autumn for thousands of water-birds, of which the golden plover is the best example. The route seems to be used by many other shore-birds, which pass directly south without troubling to follow the eastern coast line of the United States, as distance means little to these strong flyers. It is also the passage taken in part by such sea-birds as jaegers, and perhaps by the Arctic tern. As it lies at sea, it is known definitely only at the terminals or at the intermediate lands that offer points of observation. Some shore-birds that nest on the Arctic tundras of northwestern North America in autumn fly southeast to follow finally the sea road that has just been outlined.

Another regular lane extends down the eastern coast of the United States, restricted for some species to the immediate vicinity of salt water, while for others there is available inland a broad stretch of land along which minor routes of travel may be established. Many coastal points in this line are famous as points of observation both for land and water-birds as they offer a considerable diversity of natural conditions. The shore-birds that have been mentioned, so far as known, return north in spring by routes that carry them along or over the land, so that the outer sea lane is used apparently by few individuals in returning to the north.

From the interior basin that drains into Hudson Bay and the Arctic Ocean many birds converge in southward flight on the Great Lakes, and then pass directly south, as is the case with the blue goose, which travels from its breeding grounds somewhere in western Keewatin to this point and then drives south to the Gulf coast of Louisiana and Texas. Others from this same point, including ducks and geese, pass directly southeast toward the head of Delaware and Chesapeake bays and ultimately reach Currituck Sound and the coast of South Carolina. There is also migration among a few birds from the interior plains region to the southeast that brings such species as LeConte's sparrow to the coast of South Carolina.

Migrants that continue to wintering grounds beyond Florida and the Gulf Coast have now a choice of three travel lanes. One of these leads through Florida, Cuba, the Bahamas, Santo Domingo, Porto Rico, and the Lesser Antilles, to South America.

Plague of Pharaoh Still With Us

Entomology

Conclusion of reports on the Fourth International Congress of Entomology at Ithaca.

Locusts, the most ancient of man's insect enemies and one of the worst, are still being fought as they were in the days of Pharaoh. From Egypt, Russia, Mexico, many other quarters of the world, the officers who direct man's campaign against the locust hordes have brought reports to the Congress.

It is in Russia that the campaign is most highly organized and is being fought along most nearly military lines, including the use of chemical warfare methods and combat planes. In Russia and Siberia there are six principal locust species. They breed in waste places and creep about wingless in great mobs while they are young, and it is then they are attacked; for once allowed to grow wings and get into the air they would be beyond all hope of control.

Anti-locust forces sent out by the central government spot these breeding-places, often using scouting planes for the purpose. Once located, they cover with arsenical poison dust the wild grasses on which the young locusts feed, or set sweetened baits of poisoned bran and sawdust. Part of this work is done by ground machines, which might be considered a tank corps; where the ground is difficult, as in marshes, the dusting is done from airplanes.

At first, wartime gases, especially chlorpicrin, were tried, but these were found ineffectual against the locusts. However, they did wipe out great numbers of ground squirrels, which are as great a pest in parts of Russia as they are in California. The gases flow down the squirrels' dugouts, so that the more they try to escape death the more surely they go to meet it.

Locusts were not the only troubles that Paraoh's farmers had to contend with. Dr. Hassan C. Efflatoun Bey presented results of his researches into the papyri of his ancient fatherland for entomological references. In a complaining letter from the steward of an estate about 1400 B. C. he found this:

"The worm ate half the crop and the hippopotami ate the other half. The fields were full of rats, a swarm of locusts settled down and fed, the sheep also ate and the birds stole."

Egyptian entomologists, said Dr. Efflatoun, do not now need to go out and catch hippopotami, but they still have plenty of enemies to fight. The "worm" of which the steward complained is still there; it is the common cutworm. And farmers still have to be exhorted to fight it as the farmers of 3500 years ago were bidden in a royal decree. Modern pests in Egypt include the pink bollworm, fluted scale, mealybugs, Mediterranean fruit fly, and many others. In Egypt as in America, efforts are being made to gain allies from the insect camp, in the form of parasites that lay their eggs in or on the eggs, young or adults of the destroying insects.

An exchange of diplomatic views among allied generals opposing the insect armies was represented by the discussion of Dr. C. L. Marlatt, chief of the bureau of entomology, U. S. Department of Agriculture. Dr. Marlatt spoke on the plant immigration restrictions recently imposed by the United States. These regulations, designed to keep out new insect pests, he said, came very late, long after most other countries had adopted similar measures. Even while they were being debated, between 1909 and 1912, several bad pests and diseases got in, including European corn borer, Japanese beetle, citrus canker and Oriental fruit moth. Since their imposition, however, only two pests have succeeded in breaking through. These were the Mexican fruit fly and the pink bollworm, both of which crossed the southern frontier, admittedly much harder to guard than the seaports.

Even the latter enemies, Dr. Marlatt said, have been held in check. The campaign against the fruit fly especially has been spectacular. It got into the grapefruit growing region around Brownsville, Texas. To get it out, it was necessary to destroy every non-citrus fruit tree in the region, so that the pest would have nothing to live on during the seven months between grapefruit crops. But the Mexican plantings on the other side of the river still constituted a menace. These of course could not be touched by American regulations. But the Mexicans of the region voluntarily aided their American neighbors, and of their own free will destroyed all of their non-citrus fruit trees. It was, Dr. Marlatt declared, a most striking example of international goodwill and cooperation in the face of a common enemy.

A United States laboratory for the systematic study and combat of the fruit fly pest has been established in Mexico, where American entomologists work with their southern colleagues, under the leadership of Dr. Alfons Dampf, Mexican government entomologist.

The marches of the early armies of insects, in the days when there was no human race to oppose their progress in poison and traps and other paraphernalia of war, were the subject of much discussion. Their fossil chronicle in rocks a hundred million years or more in age have been read by careful human historians.

Northern Russia and Siberia had an insect fauna much like that of Kansas away back in the Permian Age, before even the dinosaurs had established their sway on the earth. Dr. Andreas B. Martynov of Leningrad reported new discoveries in the Rocks of Russia that thus linked up the ancient history of the two hemispheres. There were in those days similar species of cockroaches, dragonflies, wasps, mantids and cicádas. All these insects were of primitive types and no longer survive, but resemble their modern descendants sufficiently to be recognizable.

From the opposite end of the earth, F. W. Edwards of the British Museum brought a story of modern evidence on ancient migrations. Mr. Edwards has been collecting in the far south of Chile, in the southernmost forest of the world. There, under trees much like our northern beeches, he found insects belonging to the same genera as those of Australia, Tasmania and New Zealand. Most of this area had been unvisited since Darwin as a young man had tramped over it nearly three-quarters of a century ago. Mr. Edwards failed to find evidence there of a former land bridge connecting South America with Australia, but found some support for the so-called Wegener theory, that all the continents of the earth were once solid land mass, and that the two Americas have drifted westward, floating in a semi-liquid layer of rock beneath.

Further support of Mr. Edwards' findings was supplied by Dr. E. C. Van Dyke of the University of California, who told of the migrations of North Ameri- (*Turn to next page*)

Plague of Pharaoh—*Continued*

can insects, by Dr. W. M. Wheeler of the Bussey Institute, Cambridge, Mass., from his studies on the ants of South America and Australia, and by Prof. E. L. Bouvier of the Museum of Natural History, Paris, who has been working with the most primitive of all the creatures that walk the earth on jointed legs.

The myriads of tiny creeping things that live in the upper layers of the soil under the trees of the forest have changed but little in their preferences through almost uncounted ages, according to a note contributed by Dr. R. I. Tillyard, chief entomologist of the Australian government. He stated that he saw in England fossil plants from the Devonian Age, a period so remote that geologists hesitate to estimate its age in years. The plants then were utterly unlike the plants of today; yet the tiny life that crept among their tangled stems when they died rather closely resembled the life of the same habitat today not only in the families represented, but in the relative numbers of individuals.

Caterpillars and similar pests are more numerous in warm weather than in cool. That is a commonplace observation; it has remained for a German professor, Dr. H. Eidmann of the University of Munich, to find out why. He took butterflies of several different species and raised a number of each at ordinary temperatures, another lot in a cold room and a third lot in a room that was kept above 85 degrees Fahrenheit. Although all his butterflies started even so far as potential egg production was concerned, in all cases the ones kept in the high-temperature room laid the largest number of eggs.

Rising currents of air, which as all aviators know sometimes amount to strong winds blowing "straight up," frequently carry winged beings much smaller than flying men, and probably play an important role in the migration and distribution of insects. Such is the opinion of Dr. E. P. Felt of Stamford, Conn. Most insects, especially small ones, can not navigate, or perhaps more properly can not aviate, against a strong air current, and when one of these rising drafts catches them it may carry them thousands of feet into the air. Insect traps on airplanes and kites, and on the roofs of tall buildings in the middle of cities, have turned out catches of weak-flying ground haunters that must have been carried miles from their original habitats. Dr. Felt believes that the world-wide distribution of some of the midges, which are very weak fliers, may be accounted for on the theory of these involuntary upward parachute leaps.

The traditional fickleness of a moth will be more than ever confirmed in the minds of romanticists if the scientific findings reported before the Congress ever find their way into literary circles. For Prof. John H. Gerould of Dartmouth College told how he saw the heart of a big moth reverse itself and beat backwards, and then as if to cap the climax, start its beats in the middle and go both ways at once.

Insect hearts are not very much like those of the animals with which we are more familiar. They consist essentially of an enlarged tube with muscular walls. The rings of muscle in the walls squeeze together rhythmically, and a sort of wave-like motion sweeps over the organ from one end to the other, forcing the blood along before it. Prof. Gerould is of the opinion that this apparently fickle behavior of the insect's heart is of real physiological advantage to the creature itself, however odd it may seem to a human observer.

The Congress was hailed as the most successful meeting of its kind ever held. Over 600 persons attended, including 100 foreign delegates representing some 35 countries. The halls were a friendly Babel of languages. Frenchmen spoke German to Germans, and Germans replied in French to Frenchmen. Belgians, Czechs and Russians spoke both languages to each other. There was very evidently no question of frontier or race in this meeting of the Scientific General Staff.

The next International Congress of Entomology is to be held in Paris in 1932.

Science News-Letter, September 1, 1928

Out of 260 graduates at West Point last June, 29 per cent. chose the air service.

Medieval tradesmen believed that an amethyst would make the wearer shrewd in business.

The North Star, by which Phoenician sailors learned to steer their ships, was called the Phoenician star by the Greeks.

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SCIENCE NEWS-LETTER

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Serum for Measles

Medicine

A medical progress note prepared by the American Association for Medical Progress.

The use of convalescent serum from the blood of a person recently recovered from measles is serving to check severe epidemics of measles in cities where it is possible for the health department to obtain this serum. Where the epidemic is predominantly among very young children, however, it becomes difficult to obtain a sufficient supply of the serum, which must be obtained from adults or from older children. In a recent outbreak in Providence it was necessary, according to press reports, to restrict its use to children under four. It will therefore be interesting to follow further reports of the use of measles "anti-diplococcus" goat serum which has already been used with some success in a Chicago epidemic.

This serum was furnished by Dr. Ruth Tunnicliff of the John McCormick Institute for Infectious Diseases. In collaboration with Dr. A. L. Hoyne she succeeded in immunizing goats and in producing a serum which is both antibacterial and antitoxic—which can be counted on, that is, both to destroy the bacteria associated with the disease and to neutralize the poison that they give off. The serum was used for a small group of patients in the Cook County Hospital who had been exposed to measles. Sixty-three per cent. were successfully protected. The majority of those who developed the disease experienced it only in a light form. No complication occurred in any of the patients treated in this way, and there was no instance of serum sickness in the entire series. The experimental work seems to point to the possibility of producing a permanent immunity with little risk, by the use of a serum which can be secured in sufficient quantities to meet all the demands.

Science News-Letter, September 1, 1928

Cuba Part of Mainland

Archæology

The theories that dry land once united Cuba with the peninsula of Yucatan and that aborigines of Cuba may have been descendants of the famous Maya race of Yucatan are being discussed as a result of discoveries at Lake Mampoton in the province of Pinar del Rio.

A group of American naturalists and archæologists, cooperating with the Cuban naturalist, Dr. Carlos de la Torre, has just made soundings and excavations at this lake and has unearthed pots and other utensils bearing designs and inscriptions like those of the Maya civilization. In the same Cuban province, Dr. De la Torre has found fossil remains of mammals of a species which still exists in Mexico in the hills of Yucatan and Campeche.

Old Maya legends that tell of the flooding of much land support the theory that long ago these animals wandered afoot across what is now the Straits of Yucatan. Much later, when only the high land of the region remained above the sea to form the island of Cuba, it is suggested that the human migration took place by boat. It is believed that Maya chiefs who had been vanquished by more powerful chieftains fled with their people to the unexplored island to the east and there hid from pursuit.

Science News-Letter, September 1, 1928

Egyptian Vase Factory

Archæology

A mysterious Egyptian site occupied during the third dynasty, 2900 to 2850 B. C., has been found in the northern hills of the Fayum region. Near a gap in the hills which gives easy access to the Upper Desert and where even now there is the camel track to Giza, are great gypsum-plaster works. Here have been found immense quantities of sherds, pots, and typical flint tools which had been used in the industry.

The gypsum outcrop is of remarkable purity, and of a depth of 15 feet. There is no sign of the burning which would have been necessary to convert the gypsum into plaster, and evidently the material was exported in a raw state. Alabaster vases and dishes were evidently also manufactured on the spot in large quantities.

This quarry probably provided the fine quality gypsum plaster used at Sakkara, but none of the fine alabaster vases which were made in such numbers on this site have yet been discovered in the tombs of the Old Kingdom. The so-called alabaster vases known from this period are of different and inferior material.

Remains of the stone circle shelters used by the workmen are found nearby. These are the earliest dated examples of the structures yet found in Egypt.

Science News-Letter, September 1, 1928

Nature Ramblings

By Frank Thone

Natural History

Whip Scorpion

Travelers in the Southwest are always warned against a terrifying creature called the "vinegarone", but more often done out of Spanish into "vinegaroon", and sometimes spelled as two separate words, "vinegar roon". These fearsome beasts are said to have a constant hankering to insert their stingers into human flesh, prefering especially the ankle of a tenderfoot. And once you are stung, they tell you, your doom is sealed. The vinegarone, every good Southwesterner will take oath, is rank pizen and sure death. In Florida you will hear the same story, except there it is the "grampus" that is the coroner's best friend.

Much smoke is often sent up by a very small fire. The creature known as the vinegarone is really a most awe-inspiring little monster, looking like something between a big tarantula and a scorpion, with a pair of wicked claws thrust out before him and a long, thin, wire-like tail trembling behind. When handled or otherwise disturbed, he gives forth an odor like vinegar, whence his name. And his bad name isn't all tall tales to scare the tenderfoot; many of the natives believe them implicitly.

But the vinegarone, or whip scorpion, is as harmless as he is ugly. He does not pinch with his claws, he has no fangs with which to bite, and his long tail carries no sting. He is simply a big, shy, somewhat stupid evolutionary cousin of the really vicious scorpions, that has in the course of his racial development lost all his venom. He crawls the earth seeking what he may devour, but since he devours mostly vermin, he should be rated as a friend of man rather than as a dreaded destroyer.

Science News-Letter, September 1, 1928

Botany in the Canal Zone

Botany

PAUL C. STANDLEY, in *Flora of the Panama Canal Zone* (Govt. Printing Office):

All the Canal Zone region lies within the so-called Lower Tropical life zone, of which there are two main divisions, the Humid and Arid, the former restricted in Central America to the Atlantic slope, the latter chiefly to the Pacific watershed. Our area in both its divisions is quite representative of these subdivisions as developed upon a larger scale farther north in Central America. Since all the Isthmus is low, nowhere exceeding an elevation of 1,000 feet we can not expect that diversity of vegetation which in other parts of Central America results from a much greater variation in altitude.

The flora of the Canal Zone has been more thoroughly explored than that of any other part of Central America, of some of whose countries, indeed—Honduras, British Honduras, and Nicaragua—we know almost nothing. It is therefore possible to form a somewhat comprehensive idea of the relative rank and of the relationships of the Isthmus flora.

About 2,000 phanerogams are recorded from the Isthmus, a number which, though surprisingly low, probably can not be quite equaled by an area of the same size in the United States. The flora of the Pacific slope of the Canal Zone compares favorably in variety with that of the Pacific coast of northern Central America; but that of the Atlantic slope is, I feel sure, much less varied than the lowland flora of nearby Costa Rica, and probably the flora of other parts of the Atlantic watershed of Panama, such as Bocas del Toro and the San Blas coast. One would have every reason to expect on the Atlantic coast a much greater number of species than has been found thus far.

Furthermore, one is forced to regard the flora of the Canal Zone as uninteresting in comparison with that of other parts of Central America. There are, admittedly, numerous endemic species and some plants that do not range farther northward, but so there are in any part of Central America. The number of really interesting plants is much smaller than one will find in an equal area on the coast of Costa Rica or Guatemala, and it is astonishing that the vast amount of botanical exploration carried out in the Canal Zone since 1911 has resulted in the discovery of so few new species; an equal expenditure of effort in any other part of Central America would probably have disclosed a much greater number. This exploration has demonstrated the presence of many plants not reported by earlier collectors; nevertheless most of these are species widely distributed in Central America, the West Indies, or northern Southern America, whose occurrence here was to have been expected.

The limited number of species is explained partly by the low altitude and the restricted area, but the representation here of both the Atlantic and Pacific floras should compensate in part for these limitations. The lack of diversity in the flora is due partly to the extensive changes wrought here by man, especially during the construction of the canal. That undertaking involved the destruction of much of the forest and of many of the swamps. Agricultural developments have been responsible for the disappearance of additional forest, with which have vanished some of the most favorable places for plants. The remaining amount of virgin forest near the canal is small and the flora correspondingly limited. Land formerly stripped of its forest is overgrown with weedy shrubs, small trees, and herbs, or with coarse grasses, among which nothing of special botanical interest may be expected.

In spite of all this, the zone has much to entertain the botanist, especially one unacquainted with tropical vegetation as it exists elsewhere. The stranger from the United States finds enough new and curious types to hold his close attention for weeks or months. Nowhere else in Central America will he see the grotesque cuipo (*Cavanillesia*) trees, nowhere else so easily accessible the beautiful savannas, and in few places such a luxuriant growth of those overgrown herbs, the Heliconias.

Science News-Letter, September 1, 1928

Animal Domains

Zoology

FR. ALVERDES, in *Social Life in the Animal World* (Harcourt, Brace):

Many birds of prey lay claim to the same domain throughout the year, that is to say beyond the brooding period, and suffer no rival within their boundaries. Thus every pair of eagles of the species *Haliætus vocifer* rules a district about three kilometers in diameter. This is also true of other eagles, falcons, secretary birds, etc.

We also find the principle of territorial rights developed among some mammals. Every horde of apes possesses, as a rule, a clearly defined domain whose extent varies in different species. If two hordes encounter one another fierce fighting may ensue. Each herd of kangaroos possesses its own grazing place; sometimes it possesses several, linked together by well-trodden paths. Herds of North American prong-horned antelopes each inhabit a definite tract of country within which they travel long distances. In oriental cities every alley has its own half-wild dogs which do not dare to leave its shelter, since any dog entering a strange alley is attacked and torn to pieces by the dogs domiciled there.

Science News-Letter, September 1, 1928

The Mississippi River sweeps 528,000,000 tons of suspended matter into the sea every year.

A common bird of Porto Rico, the Antillean grebe, eats its own feathers.

Judging Revolutions

History

BARTLET BREBNER, in *Soviet Russia*

Revolutions in "close-up" are always about as incredible in their distortion of proper emphasis, and as distasteful generally, as the faces of moving-picture heroines seen in the same way. The only method by which to make them credible and to get enough setting to judge them is to push them back (in time) or, better, approach them from behind (again in time). The Russian revolution began in 1917 and is still going on. It takes courage, therefore, to venture on an explanation of it from so close as 1928, but a fairly reliable measuring-stick can be made from a glance at the centuries before 1917, and the two views combined may help to estimate the present Russia, even if they cannot completely interpret many questions which are still open to debate.

Science News-Letter, September 1, 1928

Did Roger Bacon Have a Telescope?—*Continued*

examined under a magnifying glass, proved to be made up of a great number of short strokes of the pen. These short strokes were the short hand characters, and so, in what seemed to be a single letter, there might be concealed an entire sentence.

The "michiton olabadas" key at the end proved to be made up of such characters in part, and Dr. Newbold found that when fully deciphered, it gave a short Latin verse:

"Rogerus Bacon
Adiens coelum
Hilaris festum
Cum sanctis coenarit."

Or, in English:

"I, Roger Bacon,
Drawing nigh heaven,
Gladly would feast with
The saints at their banquet."

This might have been put there, Dr. Newbold suggested, as a mnemonic rhyme, to aid in remembering the key.

With such a complicated cipher, and with such juggling required to make it into plain language, it might be thought that any gibberish might be turned into something sensible, but that the result would be from the mind of the translator, and not in the original. Those who knew Dr. Newbold testify to his high moral character, so, of course, there is no suggestion of wilful deceit. But the subconscious mind of the translator might put meaning into it. There is evidence, however, that this is not the case, and that the cipher methods as worked out by Dr. Newbold are actually correct.

In the French National Library, at Paris, there is a manuscript written by Bacon which is possibly the long-lost work that he sent to Pope Clement IV. It purports to be a medical treatise, but Dr. Newbold found that it was also in cipher and that, when deciphered, it contained some alchemical writings. The problems of alchemy, the art of changing baser metals into valuable ones, engaged the atention of many in the Middle Ages.

Part of the text which Dr. Newbold deciphered by the two-letter equivalent method that he had employed in the Voynich manuscript, proved to be a formula for preparing metallic copper. The method given is a most unusual one, one that modern chemists to whom he showed it had never heard. But Prof. Newbold's colleague in the chemistry department of the University of Pennsylvania, Prof. Hiram S. Lukens, tried it, and found that it actually worked. Since Prof. Newbold was not a chemist it is hardly possible that he could have thought, consciously or subconsciously, of this unusual method.

It is the illustrations that are most interesting, however for they together with the text accompanying them, when deciphered, may indicate that Bacon was possessed of optical aid in the form of powerful telescopes and microscopes, at least three centuries before these instruments are supposed to have been invented.

One of these drawings is of a structure consisting of two concentric rings, and connected by spiral arms. In it are a number of stars, and a cipher inscription accompanies it.

The inscription was extremely difficult to translate, wrote Dr. Newbold, but his first attempts interpreted it as telling that the object was between "the navel of Pegasus, the girdle of Andromeda and the head of Cassiopeia," and that it was seen in a concave mirror. Of course, that was long before the days of modern methods of designating stars, and the usual way was like this, from parts of the imaginary constellation figures.

Now, it happens that in this part of the constellation of Andromeda there is a spiral nebula, one of the great group of celestial objects that have within the last few years been shown to be systems of stars. They are like the system of which the sun, the Milky Way, and all the stars that we can see are part, but far outside its confines. They all have a characteristically spiral structure, but in some it is much more evident than in others. The one in Andromeda is one of the largest and nearest of these. It can just be seen with the unaided eye on a dark night, and is the only one that can be seen without (*Turn to next page*)

Astronomical Meeting Here

Astronomy

The International Astronomical Union, at which astronomers from all parts of the world meet every three years, will be held in the United States in September, 1932. This decision was reached at the meeting in Holland. The meeting will be held in 1932 instead of 1931, when three years will have elapsed, in order to accommodate astronomers from other countries who wish to view the total eclipse of the sun that will be visible in New England and eastern Canada on the afternoon of August 31, 1932.

So far the place of meeting has not been determined. Sir Frank Dyson, British Astronomer Royal, who is in charge of the Grenwich Observatory, will preside over the American meeting.

Totems Showed Trades of Clan

Anthropology

An Indian belonged to the bear or beaver clan, not so much because of a mystic brotherly affinity with that particular wild creature, as because the animal was a simple symbol of the Indian's economic class. This new interpretation of the Indian clan system has won for Dr. E. A. Bates, of Cornell University, the award of the Tyler medal, which will be presented to him in London next April.

The beaver clan drew its name from the skillful carpenters of the animal world, because these Indians wished to be known as good home builders. The wolf was the group symbol of a hunting class of Indians. The bear was the farmer's symbol.

This explanation is further borne out by the return of the Berlin African Expedition. It has found that the elephant clan of the African tribes originated similarly in the economic status of the people who dealt in transportation.

Dr. Bates will sail shortly for Europe, with the paradoxical aim of investigating there what the Indians contributed to American culture. In the attempts of scientists to reconstruct the dawn period of American history, it has been hard to distinguish what the Indians taught the white men, and what the white men taught the Indians.

Dr. Bates will trace the heritage of some of the oldest white families that came to this country, in the hope of finding out what customs of farming and housekeeping they would have brought to the new world. This will show more definitely what the typically Indian customs must have been.

Did Roger Bacon Have a Telescope?—*Continued*

optical assistance. Unfortunately for Dr. Newbold's theory, however, though this nebula is so large and bright, its spiral structure is not at all obvious. Even with a large modern telescope it does not appear spiral, but as a rather elliptical area of light. Only with photographs made with the huge instruments of present day observatories, does the spiral structure become apparent, and it is only within the past half century that such photographs have been made. The first spiral nebula to be observed as really spiral was only discovered so about 1840.

Prof. Newbold realized this objection, and suggested that "the nebula must therefore have changed considerably in appearance in six hundred and fifty years." Astronomers, however, consider such vast changes as this in such a period to be entirely beyond the realms of possibility. If it were changing so fast, comparison of the photographs made of it about thirty years ago, with those made today, would reveal changes apparent to the trained eye of the astronomer. But no such marked changes are apparent. Astronomers who have been consulted are therefore of the opinion that the interpretation of the cipher inscription by Prof. Newbold is not correct. Certainly, the evidence that Bacon had a telescope is exceedingly weak.

Bacon made some other astronomical observations, but not to require the use of a telescope. One inscription deciphered by Dr. Newbold related the appearance of a comet in 1273, and upon looking up the records he found that there was actually a prominent comet in that year. Another one described an annular eclipse of the sun, in which the sun is partly covered by the dark disc of the moon, so that a bright ring of light remains visible around it. This also checked with records of astronomical history.

When it comes to the possibility of Bacon having had a microscope, or at least some extremely powerful magnifying instrument, the evidence is a little more convincing than that for his telescope. Some of the drawings show curious elongated objects with long slender tails, that might be a representation of spermatozoa, the male generative cells. Other drawings associated with these show round structures with considerable detail. These Prof. Newbold thought, represented the ova, or egg cells of the female. The accompanying inscriptions, as deciphered, indicated that Bacon understood how the union of these two elements produces the individual. But the sperm cells are extremely small, so that even today powerful microscopes are needed to see them. They can be seen with rather primitive instruments, however, for the seventeenth century Dutch microscopist, Leeuwenhoek, did see them with an early form of the instrument.

"But," says Dr. Newbold, refering to Bacon's supposed discovery, "whether the microscope with which he saw the spermatozoa and the cells which he has so clearly depicted in the drawings was of the simple or compound type will remain an open question until the manuscript has been deciphered. Some students are of the opinion that a simple lens of high power would have sufficed."

Regardless of whether or not Bacon had a telescope or microscope, there is little doubt that he was the great genius of his age, and that his talents were not appreciated by his contemporaries. On this account, thought Dr. Newbold, Bacon decided to preserve all his knowledge in the form of this cipher, which he had devised and used on previous occasions, "in the hope that in a more sympathetic age the fruits of his labors would come to light."

That age did not dawn as soon as Bacon had hoped, said Dr. Newbold, but now, at last, after more than six centuries, the manuscript has come to light.

"The secret of the cipher has been unraveled," he says. "Difficulties, formidable difficulties, still bar the way to the reading of Bacon's manuscript, but they are less formidable than those which have been overcome. These also must be overcome before the full story can be told. But even with the text unread, the drawings alone throw a flood of light upon the achievements of Roger Bacon."

Science News-Letter, September 1, 1928

Hordes of Squirrels

Zoology

E. C. Moseley, in *Our Wild Animals* (Appleton):

For a time after the pioneers began making clearings in the forest and raising crops, the squirrels increased because of more abundant food and fewer wild enemies. According to Dr. Kirtland, red squirrels first made their appearance on the Western Reserve in northern Ohio early in the nineteenth century. By the middle of the century they had become abundant there.

Gray squirrels, too, doubtless increased in numbers when food became plentiful. In northern Ohio a hunter is said to have killed 160 in a day; 21 gray and black squirrels were seen in one tree in 1855. In White River township, Johnson County, Indiana, in 1821, gray squirrels were so numerous that on four farms not a single bushel of corn was saved from them. In one four-acre field, every ear was taken within two days after the corn had ripened. In Bartholomew County, Indiana, in 1834, there was a contest among the squirrel hunters in which one hundred persons participated. The champion killed 900 squirrels in three days; the second largest number killed was 783.

At various times and places gray squirrels have been observed to migrate. These migrations were seen in southern Wisconsin in 1842, 1847, 1852, and 1857, one each five years. Their cause is not well understood, but is thought to be due to a superabundance of the squirrels in the region from which they migrate. While migrating "many are drowned in attempting to cross streams; not a few are destroyed by man; some die from utter exhaustion, and when forced to travel in an unnatural manner upon the ground they fall an easy prey to rapacious birds and mammals, all of which feast when the squirrels migrate. During one of these migrations innumerable squirrels swam across the Niagara near Buffalo, landing so exhausted as to be easily taken by hand or knocked down with sticks."

Referring to migrations of gray squirrels in the Ohio Valley in an early day, Col. James Barker speaks of their "coming in millions from the north to the south, destroying whole fields of corn in a single day."

Science News-Letter, September 1, 1928

FIRST GLANCES AT NEW BOOKS

PHYSIOLOGY AND BIOCHEMISTRY OF BACTERIA—R. E. Buchanan and Ellis I. Fulmer—*Williams and Wilkins* ($7.50). Bacteria are the most inseparable companions of man. For good or ill they are with him every moment of his life, and they dispose of his remains when he is dead. It therefore behooves him to know how they work, that he may the more intelligently fight the bad and direct the activities of the good in agriculture, sanitary engineering, hygiene and manufacturing. To this end, the work of the present authors in summing up their own researches and collating a large and scattered literature is of unusual merit.

Bacteriology
Science News-Letter, September 1, 1928

HUNTING UNDER THE MICROSCOPE—Sir Arthur E. Shipley—*Macmillan* ($2.50). A compact little companion for the amateur as well as the more advanced microscopist, telling of the strange and often beautiful animalculæ to be seen by a "wider-opened eye".

Zoology
Science News-Letter, September 1, 1928

ECOLOGICAL SURVEY OF THE FLORA OF PORTO RICO—M. T. Cook and H. A. Gleason—*Insular Exp. Sta., Rio Piedras, P. R.* A study of the vegetation of Porto Rico, of interest to students of ecological botany. More than half the volume is made up of excellent illustrative photographs and maps.

Ecology
Science News-Letter, September 1, 1928

COLORADO PLANT LIFE—Francis Ramaley—*University of Colorado Semicentennial Publications* ($2). A thoroughgoing ecological discussion of the plant life of a State which has always been popular with botanists who seek a summer playground where they can keep on working at their favorite sport. The book will without question find its way to botanical library shelves far from its native mountains.

Ecology
Science News-Letter, September 1, 1928

THE INDIVIDUALITY OF THE PIG—Robert Morrison—*Dutton* ($6). An up-to-date book on the breeding, feeding and management of swine, briskly written and well illustrated. A book for the teacher of animal husbandry and for the practical farmer as well.

Animal Husbandry
Science News-Letter, September 1, 1928

THE FALLS OF NIAGARA—Glenn C. Forrester—*Van Nostrand* ($2.50). Tracing the geologic story of the Niagara region should, as the author suggests, give Niagara a richer and deeper significance to the thoughtful observer. This is the first complete account of the subject that has been prepared in readable style for the general public.

Geology
Science News-Letter, September 1, 1928

AFRICAN JUNGLE LIFE—A. Radclyffe Dugmore—*Macmillan* ($6). Tembo, the Elephant; Simba, the Black-Maned Lion; Mbogo, the Buffalo; Kifaru, the Rhinoceros, and Twiger, the Giraffe, have their lives recorded most graphically and interestingly. The author respects his animals, and does not try to put human brains into their skulls. And the publishers have respected their manuscript, giving it the good printing it deserves and putting in a lot of beautiful colored plates.

Zoology
Science News-Letter, September 1, 1928

SCIENCE AND RELIGION AS THEY LOOK TO A LAYMAN—Jonathan Rigdon—*Danville, Indiana, published by the author* ($1.50). A fair-minded discussion of the so-called "conflict" by a man who is sympathetic to the aims of both.

Philosophy
Science News-Letter, September 1, 1928

THE MODERN GASOLINE AUTOMOBILE—Victor W. Page—*Henley* ($5). Another edition of this comprehensive book that the enterprising young auto mechanic should cherish and those who drive could refer to with profit.

Engineering
Science News-Letter, September 1, 1928

THE EVOLUTION OF PENOLOGY IN PENNSYLVANIA—Harry E. Barnes—*Bobbs Merrill* ($5). A comprehensive historic study, from colonial days to 1927. Pennsylvania's past methods of dealing with crime are of unusual interest because prison history in this country owes considerable to Quaker ideas of prison reform. Pennsylvania has long since ceased to be a leader in penological progress, the author points out. Its modern problems and ways of meeting them are enlightening to the reader chiefly because they present a fairly typical panorama of prison conditions in a big state.

Sociology
Science News-Letter, September 1, 1928

THE FALL OF THE RUSSIAN EMPIRE—Edmund A. Walsh—*Little, Brown* ($3.50) A very human and dramatic painting of events, in which the author has wherever possible "let the leading characters tell the story in their own words, in the belief that we shall come thereby to a surer understanding of the secret prejudices, the controlling emotions, and predominant passions that so often displace pure reason as mainsprings of action."

History
Science News-Letter, September 1, 1928

FUNDAMENTALS OF HUMAN MOTIVATION—Leonard T. Troland—*Van Nostrand* ($5). Dr. Morton Prince once remarked to Dr. Troland that "the problem of motivation is the only important one in human life", and here, at last, is a comprehensive account of this rather neglected aspect of psychology. The author organizes facts and current theories as a basis for a psycho-physiological theory of his own. Since the viewpoint is conservative and yet tolerant, the book will probably be acceptable to an unusually large percentage of readers interested in the basic problems of psychology.

Psychology
Science News-Letter, September 1, 1928

STUDIES IN DECEIT—Hugh Hartshorne and Mark A. May—*Macmillan* ($4.50). The first volume by the Character Education Inquiry at Columbia University reporting on its "Studies in the Nature of Character". These two psychologists have worked out a battery of honesty tests which they used with 12,000 children. They have traced the streak of lying and cheating that runs through so many schoolrooms, that is seen at children's parties, and even in athletic contests where fairness should be the very spirit of sport.

Psychology—Education
Science News-Letter, September 1, 1928

HUMAN BEHAVIOR—Walter S. Hunter—*Univ. of Chicago Press* ($2). Only the second half of Dr. Hunter's new book is devoted to the psychological principles of normal adult behavior. The first half discusses man's prehistoric background, racial behavior, the development of the individual, and other subjects ordinarily consigned to entirely separate and bulky volumes. This organization of material gives unusual depth and perspective to general psychology.

Psychology
Science News-Letter, September 1, 1928

The New Argonautica

Astronomy

THE NEW ARGONAUTIA—W B. Drayton Henderson.—*Macmillan* ($3).

An epic is a poem of daring deeds. In the case of this epic the poem is a daring deed. For the author has had the courage to take modern astronomy as his theme, the galaxy as his scene, a Greek myth as his model and the heroes of all ages as his characters. For his New Argo is manned by an all-star crew picked from all periods, the spirits of Sir Walter Ralegh, Sir Francis Drake, Ponce de Leon, Cabeza de Vaca, Alaric, Atli, Genseric and Timur. The Argo is the symbol of the modern spirit. The Golden Fleece is the same as Maeterlinck's Blue Bird.

From a scientific point of view the interest of the epic lies in its utilization of modern ideas of the cosmos, even conceptions that have not yet been acclimated to the minds of the readers of scientific literature, still less so familiar that they as to become fit for poetical usage according to the traditional theory. For it used to be held that only antiquated words and symbols were proper in poetry, the older the better. As though poetry like fungus flourished only on ruins and decay. But the younger generation of poets is more courageous. Here is a professor of literature in a New England college employing not only the myths of Homer the visions of Dante, and the fancies of Spencer but the discoveries of Eddington and Millikan. Take for instance this picture of a star to which the vessel passed close enough to get a good view:

Standing from the edge
Of the sail's protection, studying the star,
Ralegh ignored them. 'Was it similar
To Earth's? . . . in youth? . . . how did
its loss repair?
Gust after gust of fine ethereal air
Broke through rent floccules of erupting gas
From the emissive core's conflicting mass
Of violent combustion in which heat
Systems of atoms whirled, burst, beat
With freed electrons on the flaming wall,
Expanding it; or by centripetal
Forces compelled, recombined instantly
With shattered systems, or stripped nuclei,
To whirl again in swift atomic round.

The ship in its voyage through interstellar space came so near to Algol that it was likely to be pulled in by gravitation but was saved in time by an explosion caused by the tidal action of a dark star, as Ralegh explains:

Ralegh did not turn
His eyes from their research, the shrunken star
Now fading out astern. 'Also we are
As you (he said) deep in the darkness' debt.
The dark star freed us. We were annexed yet,
The latest province to imperial light
Had not doom waked disruptions opposite
To gravity that gluts it . . .Increased mass
Brings increased pressure of ethereal gas,
As, let us say, Thessalia overcome
Made hotter conflicts at the heart of Rome.
Added to which, stretched circuits bring in course
Peripheral speed and centrifugal force
The more repellent: till, in providence,
Empires and stars stand in equivalence
Of give and get, of gather and repel.'

The mingling of ancient myth with modern science has this advantage that it shows by contrast how much more the modern conceptions appeal to the imagination; the ancient symbols belittle while the modern expand the mind. The author has an amazing wealth of illustrative material. To understand all his allusions the reader would have to be familiar with Apollonius Rhodius, the Coal Sack, the campaign of the Masurian Lakes, the lives of the Lombard kings, Egyptian theology, Aztec history, Devon geography, Evelyn's diary, Hakluyt's Voyages, Hardy's Dynasts, Wells' Outline, Gibbon's Rome, Elizabethan pharmacology, Milton, Einstein, Shapley, Dante and Dean Inge—and still he would miss many of them. But fortunately for the less learned of us the author gives very full references and interpretations in his notes and arguments. Professor Henderson is a voyager in actuality on this earth as well as in imagination in outer space. Various cantos of his epic were written while he was in Rome, Jamaica, Yale, Mt. Carmel, Montreal, Oxford, Switzerland and Dartmouth.

—EDWIN E. SLOSSON.

Science News-Letter, September 1, 1928

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FOR

SCIENCE NEWS-LETTER

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Between 1906 and 1926, rising standards of medical education created a difficult situation for smaller medical schools and the number of medical colleges in this country dropped from 162 to 80.

A committee of traffic experts, drafting a model code for cities, voted in favor of the three-color system of traffic lights, opposing the idea of eliminating the yellow light, meaning "caution".

Wild silkworms when hatched climb upward in search of leafy food, but the domestic silkworms merely wave their heads about and wait to be fed.

CLASSICS OF SCIENCE: Radio-active Substances

Chemistry

Radio-active Substances, by Mme. Sklodowski Curie; thesis presented to the Faculté des Sciences de Paris. Reprinted from the Chemical News, London, 1904.

M. Becquerel kept a piece of uranium for several years in the dark, and he has affirmed that at the end of this time the action upon a photographic plate had not sensibly altered. MM. Elster and Geitel made a similar experiment, and also found the action to remain constant.

Some researches were conducted to discover whether other substances were capable of acting similarly to the uranium compounds. M. Schmidt was the first to publish that thorium and its compounds possess exactly the same property. A similar research, made contemporaneously, gave me the same result. I published this not knowing at the time of Schmidt's publication.

We shall say that uranium, thoruim, and their compounds emit *Becquerel rays*. I have called *radio-active* those substances which generate emissions of this nature. This name has since been adopted generally.

As I have said above, I made experiments to discover whether substances other than compounds of uranium and thorium were radio-active. I undertook this research with the idea that it was scarcely probable that radio-activity, considered as an atomic property, should belong to a certain kind of matter to the exclusion of all other. The determinations I made permit me to say that, for chemical elements actually considered as such, including the rarest and most hypothetical, the compounds I investigated were always at least 100 times less active in my apparatus than metallic uranium.

The following is a summary of the substances experimented upon, either as the element or in combination:

1. All the metals or non-metals easily procurable, and some, more rare, pure products obtained from the collection of M. Etard, at the Ecole de Physique et de Chimie Industrielles de la Ville de Paris.

2. The following rare bodies: Gallium, germanium, neodymium, praseodymium, niobium, scandium, gadolinium, erbium, samarium, and rubidium (specimens lent by M. Demarcay), yttrium, ytterbium (lent by M. Urbain).

3. A large number of rocks and minerals.

MARIE SKLODOWSKI CURIE, born in Warsaw in 1867, co-discoverer of radium, twice winner of the Nobel prize

Within the limits of sensitiveness of any apparatus, I found no simple substance, other than uranium and thorium, possessing atomic radio-activity. It will be suitable to add a few words here concerning phosphorus. White moist phosphorus, placed between the plates of the condenser, causes the air between the plates to conduct. However, I do not consider this body radio-active in the same manner as thorium and uranium. For, under these conditions, phosphorus becomes oxidised and emits luminous rays, whilst uranium and thorium compounds are radio-active without showing any chemical change which can be detected by any known means. Further, phosphorus is not active in the red variety, nor in a state of combination.

In a recent work, M. Bloch has demonstrated that phosphorus, undergoing oxidation in air, gives rise to slightly motile ions, which make the air conduct, and cause condensation of aqueous vapour.

Uranium and thorium are elements which possess the highest atomic weights (240 and 232); they occur frequently in the same minerals.

I have examined many minerals in my apparatus; certain of them gave evidence of radio-activity, *e. g.*, pitchblende, thorite, orangite, fergusonite, cleveite, chalcolite, autunite, monazite, etc.

All the minerals which showed radio-activity contained uranium or thorium: their activity is therefore not surprising, but the intensity of the action in certain cases is unexpected. Thus pitchblendes (ores of uranium oxide) are found which are four times as active as metallic uranium. Chalcolite (double phosphate of copper and uranium) is twice as active as uranium. Autunite (phosphate of uranium and calcium) is as active as uranium. These facts do not accord with previous conclusions, according to which no mineral should be so active as thorium or uranium.

To throw light on this point, I prepared artificial chalcolite by the process of Debray, starting with the pure products. The process consists in mixing a solution of uranium nitrate with a solution of copper phosphate in phosphoric acid and warming to 50° or 60°. After some time, crystals of chalcolite appear in the liquid.

Chalcolite thus obtained possesses a perfectly normal activity, given by its composition; it is two and a half times less active than uranium.

It therefore appeared probable that if pitchblende, chalcolite, and autunite possess so great a degree of activity, these substances contain a small quantity of a strongly radio-active body, differing from uranium and thorium and the simple bodies actually known. I thought that if this were indeed the case, I might hope to extract this substance from the ore by the ordinary methods of chemical analysis.

Method of Research

The results of the investigation of radio-active minerals, announced in the preceding chapter, led M. Curie and myself to endeavor to extract a new radio-active body from pitchblende. Our method of procedure could only be based on radio-activity, as we know of no other property of the hypothetical substance. The following is the method pursued for a research based on radio-activity: The radio-activity of a compound is determined, and a chemical decomposition of this compound is effected; the radio-activity of all the products obtained is determined, having regard to the proportion in which the radio-active substance is distributed among them. In this way, an indication is obtained, which may to a certain extent be compared (*Turn to next page*)

Radio-Active Substances—*Continued*

to that which spectrum analysis furnishes. In order to obtain comparable figures, the activity of the substances must be determined in the solid form well dried.

Radium is a substance which accompanies the barium obtained from pitchblende; it resembles barium in its reactions, and is separated from it by difference of solubility of the chlorides in water, in dilute alcohol, or in water acidified with hydrochloric acid. We effect the separation of the chlorides of barium and radium by subjecting the mixture to fractional crystallisation, radium chloride being less soluble than that of barium.

A third strongly radio-active body has been identified in pitchblende by M. Debierne, who gave it the name of *actinium*. Actinium accompanies certain members of the iron group contained in pitchblende; it appears in particular allied to thorium, from which it has not yet been found possible to separate it. The extraction of actinium from pitchblende is a very difficult operation, the separation being as a rule incomplete.

All three of the new radio-active bodies occur in quite infinitesimal amount in pitchblende. In order to obtain them in a more concentrated condition, we were obliged to treat several tons of residue of the ore of uranium. The rough treatment was carried out in the factory; and this was followed by processes of purification and concentration. We thus succeeded in extracting from thousands of kilograms of crude material a few decigrammes of products which were exceedingly active as compared with the ore from which they were obtained. It is obvious that this process is long, arduous, and costly.

Radium is, so far, the only member of the new radio-active substances that has been isolated as the pure salt.

It was of the first importance to check, by all possible means, the hypothesis, underlying this work, of new radio-active elements. In the case of radium, spectrum analysis was the means of confirming this hypothesis.

M. Demarcay undertook the examination of the new radio-active bodies by the searching methods which he employs in the study of photographic spark spectra.

The assistance of so competent a scientist was of the greatest value to us, and we are deeply grateful to him for having consented to take up this work. The results of the spectrum analysis brought conviction to us when we were still in doubt as to the interpretation of the results of our research.

The first specimens of fairly active barium chloride containing radium, examined by M. Demarcay, exhibited together with the barium lines a new line of considerable intensity and of wave-length $\lambda = 381{\cdot}47$ *uu* in the ultra-violet. With the more active products prepared subsequently, Demarcay saw the line 381·47 *uu* more distinctly; at the same time other new lines appeared, and the intensity of the new lines was comparable with that of the barium lines. A further concentration furnished a product for which the new spectrum predominated, and the three strongest barium lines, alone visible, merely indicated the presence of this metal as an impurity. This product may be looked upon as nearly pure radium chloride. Finally, by further purification, I obtained an exceedingly pure chloride, in the spectrum of which the two chief barium lines were scarcely visible.

The general aspect of the spectrum is that of the metals of the alkaline earths; these metals are known to have well-marked line spectra with certain nebulous bands.

According to Demarcay, the position of radium may be among the bodies possessing the most sensitive spectrum reaction. I also have concluded from the work of concentration that in the first specimen examined, which showed clearly the line 3814·7, the proportion of radium must have been very small (perhaps about 0·02 per cent). Nevertheless, an activity fifty times as great as that of metallic uranium is required in order to distinguish clearly the principal radium line in the spectra photographed. With a sensitive electrometer the radio-activity of a substance only 1/100 of that of metallic uranium can be detected. It is clear that, in order to detect the presence of radium, the property of radio-activity is several thousand times more sensitive than the spectrum reaction.

Bismuth containing polonium and thorium containing actinium, both very active, examined by Demarcay, have so far each only yielded bismuth and thorium lines.

In a recent publication, M. Giesel, who is occupied in preparing radium, states that radium bromide gives a carmine flame colouration. The flame spectrum of radium contains two beautiful red bands, one line in the blue-green, and two faint lines in the violet.

Extraction of the New Radio-active Substance

The first stage of the operation consists in extracting barium with radium from the ores of uranium, also bismuth with polonium and the rare earths containing actinium from the same. These three primary products having been obtained, the next step is in each case to endeavor to isolate the new radio-active body. This second part of the treatment consists of a process of fractionation. The difficulty of finding a very perfect means of separating closely allied elements is well known; methods of fractionation are therefore quite suitable. Besides this, when a mere trace of one element is mixed with another element, no method of complete separation could be applied to the mixture, even allowing that such a method was known; in fact, one would run the risk of losing the trace of the material to be separated.

The particular object of my work has been the isolation of radium and polonium. After working for several years, I have so far only succeeded in obtaining the former.

The atomic weight of radium is Ra=225.

From its chemical properties, radium is an element of the group of alkaline earths, being the member next above barium.

From its atomic weight also, radium takes its place in Mendeleeff's table after barium with the alkaline earth metals, in the row which already contains uranium and thorium.

Characteristics of the Radium Salts.

The salts of radium, chloride, nitrate, carbonate, and sulphate, resemble those of barium when freshly prepared, but they gradually become coloured.

All the radium salts are luminous in the dark.

In their chemical properties, the salts of radium are absolutely analogous to the corresponding salts of barium. However, radium chloride is less soluble than barium chloride; the solubility of the nitrates in water is approximately the same.

The salts of radium are the source of a spontaneous and continuous evolution of heat.